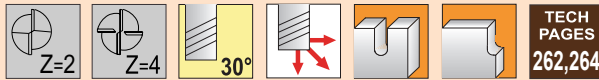


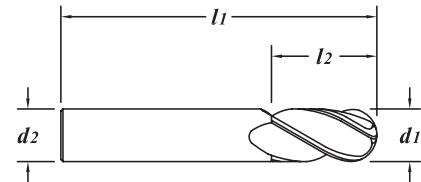
Series 180M, 190M, 980M, 990M



TOLERANCES		
d_1	$\leq .030"$	$+0.000"-.001"$ (+.000-.025mm)
	$\geq 1/32"$	$+0.000"-.002"$ (+.000-.050mm)
d_2	h6	
ball radius	$+0.000"-.001"$ (+.000-.025mm)	

Stub Length - Ball End

- Solid submicron grain carbide end mill - center cutting
- Shorter flute length for rigidity
- Extremely versatile
- TiAlN Coating - page 189
- Standard Length - page 205
- Extended length - page 231



MATERIAL HARDNESS (Rc)

70

35

0

(180M/980M) 2 Flute EDP#	(190M/990M) 4 Flute EDP#	d_1 † Diameter		d_2 Shank Diameter	l_1 Overall Length	l_2 Flute Length	1-11	12-24	25-49	50-100	
		Decimal	Metric								
03250	-	.0100	.0100"	0.254	1/8"	1-1/2"	.015"	21.71	20.77	19.82	18.88
03300	-	.0150	.0150"	0.381	1/8"	1-1/2"	.023"	21.62	20.68	19.74	18.80
03350	-	.0200	.0200"	0.508	1/8"	1-1/2"	.030"	21.05	20.13	19.22	18.30
03400	-	.0250	.0250"	0.635	1/8"	1-1/2"	.038"	20.34	19.46	18.57	17.69
03450	-	.0300	.0300"	0.762	1/8"	1-1/2"	.045"	17.53	16.76	16.00	15.24
03010	04010	.0312	1/32"	0.792	1/8"	1-1/2"	1/16"	13.00	12.43	11.87	11.30
03510	04510	.0394		1.000	3.0	38	2	13.65	13.06	12.46	11.87
03020	04020	.0469	3/64"	1.191	1/8"	1-1/2"	3/32"	13.00	12.43	11.87	11.30
03520	-	.0591		1.500	3.0	38	3	13.65	13.06	12.46	11.87
03030	04030	.0625	1/16"	1.588	1/8"	1-1/2"	1/8"	9.58	9.16	8.75	8.33
03530	04530	.0787		2.000	3.0	38	4	10.07	9.64	9.20	8.76
03040	04040	.0938	3/32"	2.383	1/8"	1-1/2"	3/16"	9.05	8.66	8.26	7.87
03540	04540	.0984		2.500	3.0	38	5	9.51	9.10	8.68	8.27
03550	04550	.1181		3.000	3.0	38	6	9.27	8.87	8.46	8.06
03050	04050	.1250	1/8"	3.175	1/8"	1-1/2"	1/4"	8.82	8.44	8.05	7.67
03560	04560	.1378		3.500	4.0	50	7	12.98	12.42	11.85	11.29
03060	04060	.1562	5/32"	3.967	3/16"	2"	5/16"	12.34	11.80	11.27	10.73
03570	04570	.1575		4.000	4.0	50	8	12.33	11.79	11.26	10.72
03580	04580	.1772		4.500	5.0	50	9.5	16.30	15.59	14.88	14.17
03070	04070	.1875	3/16"	4.763	3/16"	2"	3/8"	11.71	11.20	10.69	10.18
03590	04590	.1969		5.000	5.0	50	10	15.35	14.69	14.02	13.35
03080	04080	.2188	7/32"	5.558	1/4"	2"	7/16"	15.53	14.85	14.18	13.50
03600	04600	.2362		6.000	6.0	50	12	16.12	15.42	14.72	14.02
03090	04090	.2500	1/4"	6.350	1/4"	2"	1/2"	15.28	14.62	13.95	13.29
03610	04610	.2756		7.000	7.0	50	12	21.09	20.17	19.26	18.34
03100	04100	.3125	5/16"	7.938	5/16"	2"	1/2"	20.91	20.00	19.09	18.18
03620	04620	.3150		8.000	8.0	50	12	22.01	21.05	20.10	19.14
03630	04630	.3543		9.000	9.0	50	14	27.19	26.00	24.82	23.64
03110	04110	.3750	3/8"	9.525	3/8"	2"	5/8"	25.83	24.71	23.58	22.46
03640	04640	.3937		10.000	10.0	50	16	30.04	28.73	27.43	26.12
03120	04120	.4375	7/16"	11.113	7/16"	2-1/2"	5/8"	31.95	30.56	29.17	27.78
03660	04660	.4724		12.000	12.0	65	19	44.82	42.87	40.92	38.97
03130	04130	.5000	1/2"	12.700	1/2"	2-1/2"	5/8"	42.60	40.74	38.89	37.04
03150	04150	.7500	3/4"	19.050	3/4"	3"	1"	117.19	112.09	107.00	101.90